

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

Serial No. 10/787,432

Confirmation No. 4755

I hereby certify that this correspondence is being transmitted to the United States Patent & Trademark Office via electronic submission or facsimile on the date indicated below:

<u>12/03/2008</u>	<u>/Pamela Gerik/</u>
Date	Pamela Gerik

APPEAL BRIEF

Sir/Madam:

Further to the Notice of Appeal filed October 24, 2008, Appellant presents this Appeal Brief. Appellant hereby appeals to the Board of Patent Appeals and Interferences from the rejection of pending claims 1, 2, and 5-13 and respectfully requests that this appeal be considered by the Board.

I. REAL PARTY IN INTEREST

The subject application is owned by Schleifring und Apparatebau GmbH as evidenced by the document recorded at reel 015025 and frame 0689.

II. RELATED APPEALS AND INTERFERENCES

No appeals, interferences, or judicial proceedings are known which would directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

III. STATUS OF CLAIMS

Claims 1, 2, and 5-13 stand rejected and are the subject of this appeal. Claims 3 and 4 are canceled.

IV. STATUS OF AMENDMENTS

Claim 13 was amended subsequent to the final rejection. The Appendix hereto reflects the current state of the claims.

V. SUMMARY OF CLAIMED SUBJECT MATTER

Independent claim 1 describes a data communication system, comprising: a first unit and a second unit, wherein the first unit is configured to transmit digital signals to the second unit (Specification -- pg. 3, lines 20-25; pg. 8, lines 21-25; Fig. 1), the first unit comprising: a data transmitter for emitting first digital signals within first time intervals (Specification -- pg. 3, line 26; Fig. 1); a pseudo random-generator or a random generator for generating pseudo random values or random values, respectively (Specification -- pg. 3, lines 27-28; pg. 8, lines 25-27; Fig. 1), a combining unit for combining the first digital signals with the pseudo random values or the random values at substantially the entirety in which the first digital signals are absent (Specification -- pg. 3, lines 29-30; pg. 4, lines 4-6; pg. 8, lines 25-27; Fig. 1); and a control unit for controlling the combining unit in such a manner that pseudo random values or random values are transmitted at times other than the first time intervals (Specification -- pg. 4, lines 4-6; Figs. 1-2); and the second unit comprising: a data receiver connected to the data transmitter by a transmission path (Specification -- pg. 4, lines 1-2; Fig. 1).

Independent claim 12 describes a method for transmitting digital signals between a plurality of units of which at least one first unit comprises a data transmitter and at least one second unit comprises a data receiver, and the at least one first unit is connected by at least one transmission path to the at least one second unit (Specification -- pg. 4, lines 8-11; Fig. 1), the method comprising the steps of: inserting pseudo random values or random values at

substantially the entirety between intervals at which the first digital signals are present (Specification -- pg. 4, lines 11-12; Figs. 1-2); emitting a combination of the first digital signals and the inserted pseudo random values or random values, so that in a spectrum of a signal to be transmitted, gaps between spectral lines are substantially reduced, so that amplitudes of the spectral lines are decreased, however without substantially increasing the entire bandwidth needed for transmission (Specification -- pg. 4, lines 12-16, 20-24; Figs. 1-2).

Independent claim 13 describes a method for transmitting digital signals between a first unit comprising a data transmitter, and a second unit comprising a data receiver, the data transmitter and the data receiver are coupled by a transmission path (Specification -- pg. 4, lines 8-11; Fig. 1), the method comprising the steps of: emitting first digital signals with the data transmitter (Specification -- pg. 7, lines 11-12, Fig. 1); generating pseudo random values or random values with a pseudo random generator or a random generator (Specification -- pg. 7, lines 13-14; Fig. 1); encoding the digital information signals by combining the first digital signals with the generated pseudo random values or random values (Specification -- pg. 4, lines 11-12; pg. 7, lines 14-24; Figs. 1-2); and receiving the encoded digital signals with the data receiver (Specification -- pg. 4, lines 1-2; Fig. 1); wherein the step of encoding comprises: inserting true random data or pseudo random data in substantially all intervals between the first digital signals (Specification -- pg. 4, lines 12-16, 20-24; pg. 7, lines 17-21; Figs. 1-2); and forming a combination of the true random data or pseudo random data between the first digital signal (Specification -- pg. 7, lines 23-25; Figs. 1-2).

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

1. Claims 1, 6, 12, and 13 stand rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 7,072,289 to Yang (hereinafter “Yang”).
2. Claim 2 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Yang.
3. Claims 5 and 7-9 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Yang in view of U.S. Patent No. 5,793,318 to Jewett (hereinafter “Jewett”).

4. Claim 10 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Yang, Jewett, and U.S. Patent No. 5,007,088 to Ooi (hereinafter “Ooi”).
5. Claim 11 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Yang, Jewett, Ooi, and U.S. Patent No. 4,835,517 to Van der Gracht (hereinafter “Van der Gracht”).

VII. ARGUMENT

The contentions of the Appellant with respect to the ground of rejection presented for review, and the basis thereof, with citations of the statutes, regulations, authorities, and parts of the record relied upon are presented herein for consideration by the Board. Details as to why the rejections cannot be sustained are set forth below.

1. Rejection of Claims 1, 6, 12, and 13

Claims 1, 6, 12, and 13 stand rejected under 35 U.S.C. § 102(e) as being anticipated by Yang. The standard for “anticipation” is one of fairly strict identity. A claim is anticipated only if each and every element as set forth in the claim is found, either expressly or inherently described, in a single prior art of reference. *Verdegaal Bros. v. Union Oil Co. of California*, 2 USPQ2d 1051, 1053 (Fed. Cir. 1987); MPEP 2131. Furthermore, anticipation requires the presence in a single prior art reference disclosure of each and every element of the claimed invention, as arranged in the claim. *W.L. Gore & Assocs. V. Garlock*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983). Using these standards, Applicants submit the cited art fails to disclose each and every element of the currently pending claims, some distinctive features of which are set forth in more detail below.

Independent claims 1, 12, and 13 recite a combining unit (claim 1) or an inserting step (claims 12, 13). The combining unit 12 allows for the combining or insertion of pseudo-random values generated by generator 6 into first digital signals generated by transmitter 4 (Specification -- pg. 9, lines 11-31, Fig. 1). The first digital signals are referenced in the present specification

as data, e.g., “data transmitter 4,” as transmitting data (Specification -- pg. 8, lines 23-24), and the signal 20 being “information data” (Specification -- pg. 9, lines 13-18; Fig. 2). As opposed to pseudo-random values, the first digital signal constitutes information data and, specifically, data reflective of the information of interest that will be extracted from pseudo-random code at the second unit 2, and forwarded to data receiver 5 (Specification -- pg. 9; Fig. 1).

Yang does not teach combining (or inserting) pseudo-random values in substantially the entirety in which first digital data signals are absent. As noted, independent claims 1, 12, and 13 each recite combining or inserting pseudo-random values in substantially the entirety in which the first digital data signals are absent. The Office Action alleges that Yang combines pseudo-random values “at substantially the entirety of intervals in which the first digital signals are absent” (Office Action -- pg. 3). The Office Action further alleges that DFT blocks or frame bodies labeled 21A, 21B, and 21C in Figs. 2A, 2B, and 2C of Yang constitute the claimed first digital data signals (Office Action -- pg. 3). Appellants respectfully disagree.

Although Yang does not define “DFT,” Appellants believe DFT stands for “Discrete Fourier Transform.” Moreover, Yang makes clear that DFT 21A, 21B, and 21C represent a block or frame body (Yang -- col. 3, lines 1-17, 31-34). As a block or frame body, Yang also makes clear that DFT includes both a “header” and a “payload” (Yang -- col. 3, lines 35-44). The header portion of DFT 21A, 21B, or 21C includes information about the “frame source, frame destination, sequence number, frame window size, if any, data type (supervisory information, unnumbered), data payload size . . .” (Yang -- col. 3, lines 36-42). As clearly noted in Yang, the actual data does not occur until the “payload” which follows the header (Yang -- col. 3, lines 43-44). In fact, Yang calls “payload,” the “data payload itself” (Yang -- col. 3, lines 43-44).

This is consistent with the IEEE Dictionary or, specifically, The New IEEE Standard Dictionary of Electrical and Electronic Terms, Fifth Edition, 1993, which defines a frame, not as data, but as “a set of consecutive digit timeslots in which the position of each digit timeslot can be identified by reference to a framing signal” (The New IEEE Standard Dictionary of Electrical and Electronic Terms, Fifth Edition, 1993 -- pg. 523, Exhibit B). Moreover, the term packet is

defined as “a group of binary digits including data and control elements which is switched and transmitted as a composite whole” (The New IEEE Standard Dictionary of Electrical and Electronic Terms, Fifth Edition, 1993 -- pg. 911, emphasis added, Exhibit C). Thus, the use of the term frame, body, or block is consistent with the IEEE terminology in that a frame body or block is space or timeslots dedicated to be consistently referenced through a framing signal, and that space can include binary digits associated with a packet, and that a packet includes data and control elements. A popular set of control elements includes a “header” as explained in Yang. Thus, DFT block or frame body is merely space which can accommodate an information packet containing a header followed by a payload. It is only the payload that contains data. The header does not connote data, but instead describes the data type or information as to source, size, or destination, etc. The IEEE Dictionary makes clear that the header is, in fact, not data as confirmed in Yang which describes the data only existing in the payload itself.

Thus, Yang describes placing pseudo-random or pseudo-noise (PN) sequences between DFT blocks or frame bodies. However, each block or frame body contains data and non-data header information. Since Yang only teaches places PN between blocks, the header information within each block, exclusive of the payload data, does not contain PN values. Therefore, Yang cannot teach placing pseudo-random values in substantially the entirety in which digital data signals are absent. In fact, Yang describes not placing PN values in the header portion of DFT, where data of the payload is absent.

Yang is not available as prior art. A declaration under 37 C.F.R. § 131 was filed May 20, 2008. In that declaration, Appellants assert that the inventors Lohr and Schilling conceived of their invention before the filing date of Yang, June 1, 2001. Submitted with the declaration was an Exhibit A having a date before June 1, 2001. Exhibit A described feature of the claimed invention, including inserting pseudo-random or random patterns into static/idle patterns in which the transmitters are not sending valid data (Declaration, Exhibit A, pp. 4-6). Exhibit A was submitted to show conception before June 1, 2001. Shortly thereafter, while testing and experiments were run on several CT machines, as those machines were made available to the inventors, a German patent application 10142102.8 was filed August 30, 2001. The present

application claims priority to the German patent application via International Application PCT/DE02/03024 filed August 19, 2002.

In the Office Action, the Examiner deems the declaration and evidence insufficient to establish diligence from a date prior to the date of reduction to practice to the filing date of Yang (Office Action -- pg. 8). Moreover, the Examiner alleges the declaration fails to disclose conception of the claimed invention for combining or inserting pseudo-random values in substantially the entirety in which digital data signals are absent.

Addressing the allegation of insufficient diligence: Appellants wish to point out that the critical period for due diligence is roughly 3 months -- between June 1, 2001 (filing date of Yang) and August 30, 2001 (filing date of priority German application). This timeframe includes approximately 60 business days. Upon reviewing the file, the Examiner would note that the agent who prepared the German priority application (10142102.8) is also the inventor (Georg Lohr). While it can be appreciated that patent agents and patent attorneys cannot prepare and get approval for filing a patent application overnight, certainly in the case of having multiple inventors, Georg Lohr must prepare the application with sufficient breadth and scope, and including all embodiments, obtain approval, and file the German application within 60 business days.

Therefore, for the Examiner to issue a blanket allegation that additional factual evidence from the inventors is needed to support due diligence in the context of merely 60 business days, with co-inventor Georg Lohr busily preparing and filing the priority German application, is without merit. While Appellants can understand the possibility of abandonment or suppression given a critical period of six months or a year, for example, in this case, the inventors were busily preparing, reviewing, and revising the German priority application, including the legal ramifications of finalizing and filing the priority German application. Therefore, Appellants respectfully disagree with the conclusion that the inventors, one of which is also the German patent attorney, were not duly diligent.

Addressing the allegation of failure to show conception: The Office Action alleges that “Fig. 8 and page 6, lines 3-5 however, do not show that the random sequence is combined with data signals only at intervals where the data signals are absent as evidence by the link output in fig. 8” (Office Action -- pg. 9). However, the Office Action does not take into account the relevant portions of Exhibit A, which is not page 6, lines 3-5, but lines 11-24. Specifically, page 6 notes that “[i]nstead of sending no data there could be sent the same blocks which are used for data but filled with zeros or some other pattern which can be identified as no data” (Declaration, Exhibit A, pg. 6, lines 16-18, emphasis added). By filling regions where there is no data with zeros or other patterns, such as a pseudo-random pattern, Exhibit A does indeed provide support for combining or inserting pseudo-random values in substantially the entirety in which digital data signals are absent, as claimed.

Therefore, pursuant to MPEP 2138.04, conception is made sufficiently clear in Exhibit A to enable one skilled in the art to reduce to practice without exercise of extensive experimentation or the exercise of inventive skills. In fact, the relevant portion of Exhibit A, page 6, as well as pages 4-5, specifically describe inserting pseudo-random or random patterns into the static/idle patterns of data in which the transmitters are not sending valid data -- this is what is claimed. Further, page 4 of Exhibit A notes that when there is an idle pattern of data, then a transmitter which sends pseudo-random sequences will be sent over the link during that idle pattern. Exhibit A, page 4 coupled with page 6, notes that the idle periods of data will be substantially filled with the pseudo-random pattern.

Therefore, Appellants assert there is sufficient documentation contained in the declaration and Exhibit A to enable a skilled artisan to reduce the claimed invention to practice without exercise of extensive experimentation or inventive skills. Moreover, Appellants assert that diligence is also evident during the critical period.

Accordingly, Appellants assert that Yang is not available as prior art against the present claims. Furthermore, even if Yang is applied against the present claims, Yang does not anticipate independent claims 1, 12, and 13, as well as claims dependent therefrom, for at least the reasons discussed herein.

2. Rejection of Claim 2

Claim 2 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Yang. Dependent claim 2 is patentably distinct over Yang for at least the same reasons as base claim 1 discussed above.

3. Rejection of Claims 5 and 7-9

Claims 5 and 7-9 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Yang in view of Jewett. Dependent claims 5 and 7-9 are patentably distinct over Yang, individually or in combination with Jewett, for at least the same reasons as base claim 1 discussed above.

4. Rejection of Claim 10

Claim 10 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Yang, Jewett, and Ooi. Dependent claim 10 is patentably distinct over Yang, individually or in combination with Jewett and Ooi, for at least the same reasons as base claim 1 discussed above.

5. Rejection of Claim 11

Claim 11 stands rejected under 35 U.S.C. § 103(a) as being unpatentable over Yang, Jewett, Ooi, and Van der Gracht. Dependent claim 11 is patentably distinct over Yang, individually or in combination with Jewett, Ooi, and Van der Gracht, for at least the same reasons as base claim 1 discussed above.

* * *

For the foregoing reasons, it is submitted that the Examiner's rejection of and objection to pending claims 1, 2, and 5-13 was erroneous, and reversal of the Examiner's decision is respectfully requested.

The Commissioner is hereby authorized to charge the required fee(s) or credit any overpayment to Daffer McDaniel, LLP deposit account number 50-3268.

Respectfully submitted,

/Kevin L. Daffer/

Kevin L. Daffer

Reg. No. 34,146

Attorney for Appellant

Customer No. 35617

Date: December 3, 2008

KLD

VIII. APPENDIX

The present claims on appeal are as follows.

1. A data communication system, comprising:
 - a first unit and a second unit, wherein the first unit is configured to transmit digital signals to the second unit, the first unit comprising:
 - a data transmitter for emitting first digital signals within first time intervals;
 - a pseudo random-generator or a random generator for generating pseudo random values or random values, respectively,
 - a combining unit for combining the first digital signals with the pseudo random values or the random values at substantially the entirety in which the first digital signals are absent; and
 - a control unit for controlling the combining unit in such a manner that pseudo random values or random values are transmitted at times other than the first time intervals;and the second unit comprising:
 - a data receiver connected to the data transmitter by a transmission path.
2. The data communication system according to claim 1, wherein a signaling line is provided between the data transmitter and the data receiver, wherein the data transmitter signals the presence of first digital signals, pseudo random values, or random values to the data receiver.
5. The data communication system according to claim 1, wherein an additional transmission path for transmitting the pseudo random values or random values is provided, so that at the second unit a combination with the pseudo random values or random values takes place synchronously with a combining with the pseudo random values or random values at the first unit.

6. The data communication system according to claim 1, wherein the second unit comprises a second pseudo random-generator or random generator for generating pseudo random values or random values of a same sequence as the pseudo random generator of the first unit.
7. The data communication system according to claim 6, wherein an additional transmission path is provided for synchronizing the pseudo random generator or random generator of the first unit and the pseudo random generator or random generator of the second unit.
8. The data communication system according to claim 6, further comprising a unit for synchronizing the pseudo random generators or random generators of the first unit and the second unit.
9. The data communication system according to claim 8, wherein the unit for synchronizing the pseudo random generators or random generators of the first unit and the second unit is designed so that at a beginning of each signal transmission a synchronization sequence is used instead of pseudo random values or random values, which enables a synchronization of the pseudo random generators or random generators of the first unit and the second unit.
10. The data communication system according to claim 9, wherein for the synchronization sequence, the data transmitter is adapted to emit a predetermined or known bit pattern which is then combined with pseudo random values or random values of the pseudo random generator or random generator of the first unit by the combining unit connected on an output side of the pseudo random generator or random generator; and a control unit of the second unit is adapted to perform at various times a synchronization of the pseudo random generator or random generator of the second unit with received data from the first unit.
11. The data communication system according to claim 10, wherein for simplified synchronization between the data transmitter and the data receiver, a short pseudo random or random sequence is used at first, and after a given period of time, or after a synchronization with this pseudo random or random sequence, a switch-over is made to a longer pseudo random or random sequence.

12. A method for transmitting digital signals between a plurality of units of which at least one first unit comprises a data transmitter and at least one second unit comprises a data receiver, and the at least one first unit is connected by at least one transmission path to the at least one second unit, the method comprising the steps of:

inserting pseudo random values or random values at substantially the entirety between intervals at which the first digital signals are present;
emitting a combination of the first digital signals and the inserted pseudo random values or random values, so that in a spectrum of a signal to be transmitted, gaps between spectral lines are substantially reduced, so that amplitudes of the spectral lines are decreased, however without substantially increasing the entire bandwidth needed for transmission.

13. A method for transmitting digital signals between a first unit comprising a data transmitter, and a second unit comprising a data receiver, the data transmitter and the data receiver are coupled by a transmission path, the method comprising the steps of:

- emitting first digital signals with the data transmitter;
 - generating pseudo random values or random values with a pseudo random generator or a random generator;
 - encoding the digital information signals by combining the first digital signals with the generated pseudo random values or random values; and
 - receiving the encoded digital signals with the data receiver;
- wherein the step of encoding comprises:
- inserting true random data or pseudo random data in substantially all intervals between the first digital signals; and
 - forming a combination of the true random data or pseudo random data between the first digital signal.

IX. EVIDENCE APPENDIX

A declaration under 37 C.F.R. 1.131 was filed May 20, 2008 to show evidence that the claimed subject matter was conceived before that of Yang (Exhibit A). Such declaration was considered by the Examiner, but nonetheless deemed ineffective to overcome the Yang reference.

X. RELATED PROCEEDINGS APPENDIX

No prior or pending appeals, interferences, or judicial proceedings are known to Appellant or Assignee which would directly affect or be directly affected by or have a bearing on the Board's decision in this appeal.

EXHIBIT A

PATENT
5858-01900 SR 2000/20 US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Serial No. 10/787,432
Confirmation No. 4755

I hereby certify that this correspondence is being transmitted to the United States Patent & Trademark Office via electronic submission or facsimile on the date indicated below:

05/20/2008
Date

/Pamela Gerik/
Pamela Gerik

DECLARATION UNDER 37 C.F.R. 1.131

Harry Schilling and Georg Lohr, hereby declare and state that:

1. We are the named co-inventors in the above-identified U.S. Patent Application, Serial No. 10/787,432, filed February 26, 2004.
2. We have been informed that in the present application, certain claims have been rejected on reference to U.S. Patent No. 7,072,289 to Yang et al. (hereinafter "Yang"), issued July 4, 2006 and filed on June 1, 2001.

CONCEPTION

3. As set forth in more detail below, we conceived the subject matter claimed in the present application before June 1, 2001. The subject matter involves the suppression of electromagnetic interference (EMI) during transmission of digital signals. Pseudo random or random values placed within idle periods in which no digital signals are present improve electromagnetic compatibility. Gaps between spectral lines are substantially reduced, and amplitudes of the spectral lines are decreased. Inserting pseudo random or random values in idle periods between

which digital signals are present is particularly suited in computer tomograph (CT) scanning, where idle periods of no data transmission can be relatively long.

4. Exhibit A attached hereto is a true and correct copy of a document written by ourselves, and submitted to our employer, Schleifring und Apparatebau GmbH, assignee of the above-identified U.S. Patent Application. At the bottom of each page of this document is a date corroborated by us as a correct date in which we created the document, and that date is before June 1, 2001. The actual date from the bottom of each page has been redacted from Exhibit A.

5. Exhibit A describes and illustrates the presently claimed features of a data communication system having a first unit transmitter and a second unit receiver (Exhibit A -- pp. 1 and 2); a pseudo random or random generator for generating pseudo random or random patterns (Exhibit A -- pp. 3 and 4); wherein the pseudo random or random patterns can be inserted into the static/idle patterns in which the transmitters are not sending valid data (Exhibit A -- pp. 4, 5 and 6). Test results of my invention are shown in Exhibit A, associated with spectrum measurements, were also used in the above-identified U.S. Patent Application (Exhibit A -- Figs. 8, 9, 10, and 12).

REDUCTION TO PRACTICE AND DILIGENCE

6. As set forth in more detail below, we began testing our invention set forth in Exhibit A to ensure it would work for its intended application and purpose. Shortly after completing our initial idea described in Exhibit A, we set experiments, simulation bench tests, laboratory mock ups, and actual device interoperability testing to validate our ideas would operate not only in the laboratory but also in the field.

7. Exhibit B attached hereto is an internal correspondence memo in German language, in both the original German language and translated by me (Georg Lohr) to English, from Kurt Dolhofer, president of Schleifring und Apparatebau GmbH, dated October 17, 2000, indicating

that our employer has taken ownership of our invention and to allow us to continue research and work on our ideas.

8. With adequate funding, we worked diligently on our ideas, experimenting, testing, and modifying some operability of our invention beginning at the time of our conception, throughout the fourth quarter of 2000 and into the first and second quarter of 2001. We made various changes to our invention in order to ensure its operability in accordance with Exhibit A, primarily in the computer tomograph (CT) field. Testing and experimenting continued as we discovered certain unique problems associated with EMI in the CT field. More testing and experiments were run on several CT machines as those machines were made available to us, beginning in late 2000 through the date our invention was approved for drafting a patent application and when a German Patent Application 101 42 102.8 was filed on August 30, 2001. Thereafter an International Patent Application was filed as PCT/DE02/03024 on August 19, 2002 designating the United States and claimed priority to German Patent Application 101 42 102.8. Thereafter the captioned U.S. Patent Application was filed claiming priority to International Patent Application No. PCT/DE02/03024.

9. We continued working on, testing and generally increasing certain functionality of our invention throughout the critical time period extending from a time just prior to June 1, 2001 through the date in which German Patent Application 101 42 102.8 was filed. We did not abandon, suppress, or conceal the ideas set forth in the claimed invention during at least the time beginning prior to June 1, 2001 through the date of constructive reduction to practice on August 30, 2001.

10. We were duly diligent during the critical time period extending from a time just prior to June 1, 2001 through the date of constructive reduction to practice, and we continued to work on the ideas set forth in Exhibits A and B by building, testing, experimenting with, and generally improving the operation of the invention throughout the critical period. After performing the mental steps required to conceive the invention, the inventive concepts were simulated, bench tested and proved functional on various models of CT scanners, as well as other devices.

11. Upon information and belief, it is my informed understanding that diligence in reducing the invention to practice was, therefore, maintained from prior to June 1, 2001 through the date of constructive reduction to practice of our invention on August 30, 2001.

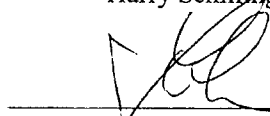
12. We hereby declare that all statements made herein of our own knowledge are true and that all statements made herein on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. § 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Date: 22.04.2008



Harry Schilling

Date: 27.04.2008



Georg Lohr

1 Frequency Spectrum of Digital Signals

As in almost every digital data link the data stream is in PCM format, which means there are only two digital levels, zero and one. The information is contained in the presence of zeroes or ones in specific time slots. For a signal with alternating zeroes and ones the waveform looks like a symmetrical square wave (Fig. 1) with a frequency that is half the bit clock rate.

Exhibit A

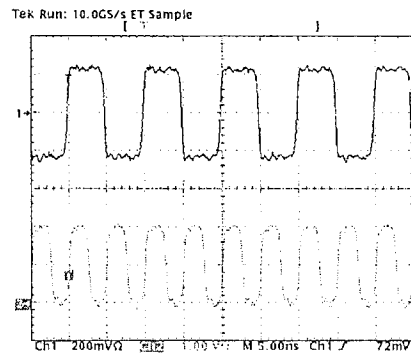


Fig. 1: 200 MBaud 1010 PCM signal (upper trace) and bit clock (lower trace)

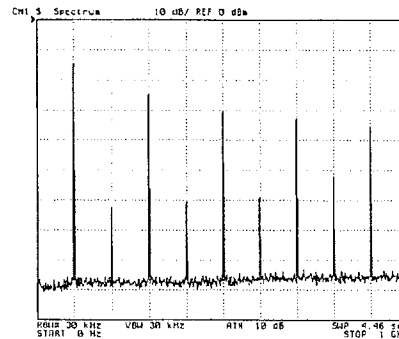


Fig. 2: 200 MBaud 1010 PCM signal spectrum 0...1GHz.

Such a signal has the well-known spectrum, which is shown in Fig. 2.

There are only odd harmonics with linear decreasing amplitude. Even harmonics appear only, if the signal is unsymmetrical. When the signal has other patterns with larger time intervals of

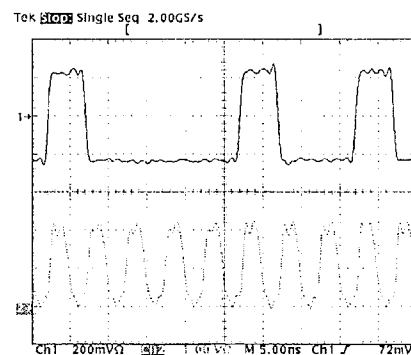


Fig. 3: 200 MBaud PCM signal with 10000100 pattern (upper trace) and bit clock (lower trace).

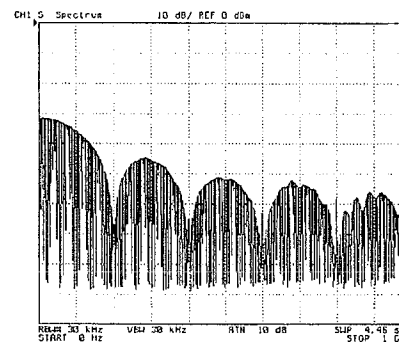


Fig. 4: 200 MBaud PCM signal (10000100) spectrum 0...1GHz.

zeroes or ones like the signal in Fig. 3, then in the spectrum appear side bands with offsets of

1.1 Common Data Encoding Schemes

Usually data is packaged into frames which contain additional frame and error checking bits [6]. These additional bits are also necessary to synchronize the data receiver to the transmitter. Often some specific encoding like 8B/10B is used to perform these tasks. So an extremely long data stream consisting only of zeroes or ones would never appear. Typical frames containing synchronization and error correction bits have sizes n_{Frame} of about 10 to 20 bits. This gives a lower frequency limit and spectral line spacing at the frame repetition rate, even if the data contain only zeroes or ones. With a data clock rate f_{Data} the lower frequency limit f_{Min} and the minimum spectral line spacing is

$$f_{Min} = \frac{f_{Data}}{n_{Frame}} \quad (1)$$

In addition data is usually encoded to be DC-free and to increase redundancy for simple error detection. Both, data packaging and encoding helps spreading up the spectrum. The small package size gives a relatively high package repetition rate and therefore a moderate spectrum spreading effect. For example a 10 bit frame gives at a data clock rate of 200MHz a spectral line spacing of

$$f_{Min} = \frac{200MHz}{10} = 20MHz \quad (2)$$

This means that in the spectrum appear not only spectral lines at 100MHz, 300MHz, 500MHz, etc. but additional lines spaced at 20 MHz. This gives five times more spectral lines with an average decrease of 7dB in power. Such an encoding alone is not good enough for an efficient EMI suppression.

1.2 Pseudo Random Patterns

A data stream having a random sequence of zeroes and ones gives a very even spectral distribution. Theoretically an infinite random sequence will cause a perfect spread spectrum with constant spectral power density. Unfortunately such a data stream cannot contain the desired information. To solve this problem deterministic pseudo random patterns can be used. These consist of a predetermined, reproducible sequence of bits. Usually the length of these patterns is fixed. These patterns are called pseudo random patterns because at the first glance they look like a random sequence but they have a fixed sequence and can be predicted. A real random sequence never can be predicted.

1.2.1 Influence of Pattern Length on Spectral Density

Practically used pseudo random patterns have a limited pattern length. After transmitting n_p bits the same pattern is repeated. The reasons for short patterns are limited storage for the pattern and easier synchronization. A long pattern and therefore a low pattern repetition rate result in low frequency components in the signal and therefore in a close spectral line spacing. The minimum distance Δf of adjacent spectral lines is inversely proportional to the random pattern length n_p .

$$\Delta f = \frac{f_D}{n_p} \quad (3)$$

So a large pattern length is desirable for a low spectral line spacing. The influence of pattern length is shown in Fig. 5, Fig. 6 and Fig. 7.

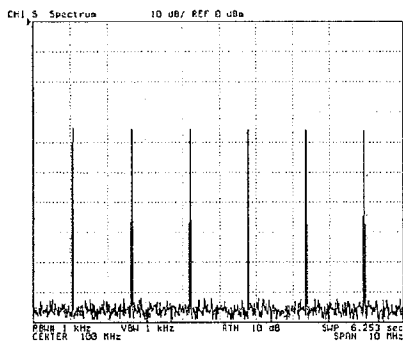


Fig. 5: 200 MBaud PCM PN7 Spectrum (pseudo noise with 128 bit pattern length); peak amplitude is -36 dBm and line spacing is 1.56 MHz.

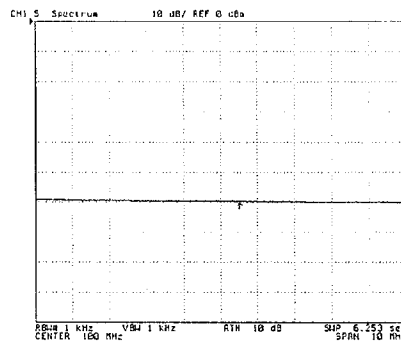


Fig. 6: 200 MBaud PCM PN15 Spectrum (pseudo noise with 32768 bit pattern length); floor is -60 dBm and line spacing is 6.1 kHz.

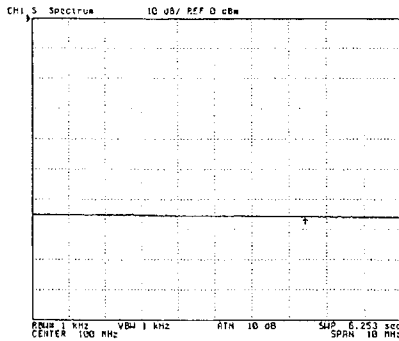


Fig. 7: 200 MBaud PCM PN17 Spectrum (pseudo noise with 131072 bit pattern length); floor is at -54 dBm and line spacing is 1.5 kHz.

In Fig. 5 the spectral lines are spaced at 1,56 MHz, their amplitude is -36dBm. When a longer code sequence is selected as in Fig. 6 where the pattern length is 256 times longer then the spectral lines are spaced at 6.1 kHz. This is below the resolution of the spectrum analyzer which displays a straight line. The amplitude of the spectral lines (which is identical to the amplitude of the line) is with -60 dBm exactly 1/256 of the previous amplitude of -36 dBm. A four times longer pattern length is applied in Fig. 7 resulting in a 4 times lower (-6 dB) signal amplitude.

1.2.2 State of the art application of pseudo random patterns

A simple approach for very short pseudo random sequences is a coding scheme like the common used 4B/5B or 8B/10B encoding [1]. Here 8 bit binary numbers are encoded into a sequence of 10 changing bits. So even a 0 will not result in a long sequence of zero bits. These patterns have a slight spreading effect as described in chapter 1.1 but give a more even spectral distribution.

Furthermore a very common use of pseudo random patterns are bit error rate tests where the broadband spectrum of these pattern permit a thorough test of the whole transmission system.

1.3 Static Patterns

Most serial transmitters use an idle signal when there is no data to be transmitted. This idle signal is a unique pattern which permits identification as „no data“ and helps the receiver to be synchronized to the transmitter clock. Usually there is only one type of idle pattern. When no data is transmitted over long periods of time then only this pattern will be sent over the link. It has the same length as a standard data word and therefore a comparatively high lower frequency and spectral line spacing which is given by equation (5). Usually such patterns do

not have an even distribution of their spectral lines. As a consequence a high speed data link can have excellent EMI characteristics when real data is transmitted. But in the moment when transmission stops and an idle signal is transmitted the EMI performance is very poor. These static patterns are the worst case for electromagnetic emission. If transmission of these patterns cannot be avoided over longer periods the EMI measurement should be conducted under this condition.

In a good system design such static patterns should be avoided under any circumstances. This can be done by sending varying customer idle signals or by sending a pseudo random sequence which signals the idle state. Even a long sequence of 0 codes can be accepted if it is encoded with a pseudo noise signal with a long pattern length (chapter 3.1).

2 Influence of a Spread Spectrum on EMI Performance

The general term EMI-performance is very difficult to define. This document refers to the very common standard CISPR 11. This standard gives limits for the maximum emission of electromagnetic energy and cites the appropriate measurement procedures. This standard specifies a measurement for radiated emissions in the frequency range of 30 MHz to 1 GHz. Radiated power is measured at 120 kHz steps with 120 kHz bandwidth. When applying any spectrum spreading technique, it is not absolutely necessary to have an even distributed broadband spectrum, it is only necessary to take care that every 120 kHz slot gets the same energy. This can be achieved by broadband signal or single narrowband peak in that slot. For most applications spreading up this spectrum in lines which are in a distance of 120 kHz or with some safety margin 100 kHz of each other is the most economic solution. Further spreading of this spectrum requires introducing very low frequency changes in the data stream. In some applications these changes occur naturally when real world data like video are transmitted. But care should be taken that in extreme situations, when i.e. the video signal is off and only digital zeroes are transmitted, the spectrum is spread wide enough to meet the EMI regulations.

Kommentar [Lo1]: Stimmt das

3 Methods for Spreading up Bandwidth

As we have seen before there are different ways for spreading up the spectrum. The best effect on electromagnetic emission is obtained when at least two methods, complementing each other, are applied. A very good combination is a pseudo noise data encoding together with some kind of data timing modulation. Data timing can be modulated in different ways. One way is to modify the original data clock at the transmitter. Another way is to modify the timing of the data stream itself.

3.1 Data Encoding

As shown in the last chapter for optimum EMI performance the data stream should look like a random sequence. Very often real world data has random characteristics. In measurement

signals or video images, there is always some noise which introduces the random characteristics. In other cases coding the data stream with a random sequence would bring a desired result. This coding can be done very easy. If data is transmitted in big blocks, each block could be XORed (exclusive or) with a given random sequence (Fig. 8). Now the transmitted signal looks like a random signal. Even in the worst case of a sequence of zeroes or ones the signal looks like a random signal.

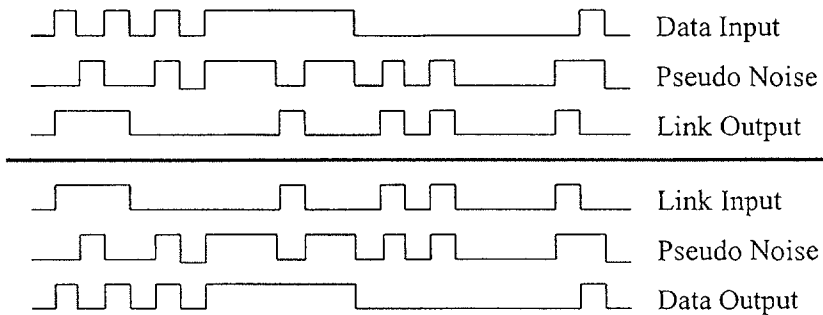


Fig. 8: Random encoding (upper three traces) and decoding (lower three traces). Encoding is done by applying the exclusive or function to the data and a pseudo noise sequence.

The receiver can reconstruct the original data by XORing the block with the same random sequence as the original data block. As an alternative the signal could be fed into a classic pseudo random generator which can be based on shift registers with feedback [4].

There are special situations which should be taken care of. Most data serializers have a fixed 'no data' signal which helps them to synchronize in the case of lack of data. If the serializer gets no data it will continuously transmit this short data word, which usually consists of a sequence of 10 to 20 Bits (Chapter 1.3). This signal gives a very wide frequency line spacing and therefore very poor EMI characteristics. So under any circumstances it must be prevented a static pattern to be transmitted. To prevent this the serializer must be fed with data. This can be done by a simple software change. Instead of sending no data there could be sent the same blocks which are used for data but filled with zeros or some other pattern which can be identified as no data. When the stream of zeros is XORed (exclusive or) by the random pattern, it gives a perfect random pattern at the data link and therefore best EMI-performance. At the receiver after XORing the random pattern the stream of zeros can be easily identified as no data.

As shown in chapter 1.2.1 the spectral line distance is inverse to the pseudo random pattern length. The minimum spectral line distance can be calculated by equation (3). To complement data encoding some timing modulation technique should be used. Unless very long code

3.2 Measurements of Modified Digital Signals

Some final measurements show the benefits of a spread spectrum PCM signal. In Fig. 9 a worst case 1010 PCM signal at 200 MBaud is shown. Here the peak amplitude is -14.7 dBm at 100 MHz. When a real 8B/10B encoded signal is applied, the spectrum looks like Fig. 10. Now in this example the maximum amplitude is -20.6 dBm and the minimum distance of spectral lines is 20 MHz. Due to the short length encoding this spectrum is not evenly spread. It has no constant power density, which would be desirable, but some peaks with zeroes in between. But even this brings an improvement of about 6 dB over the 1010 worst case signal.

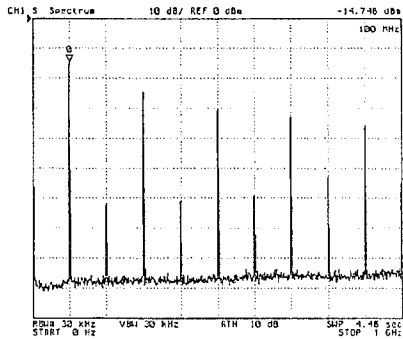


Fig. 9: 200 MBaud 1010 PCM signal spectrum 0...1GHz.

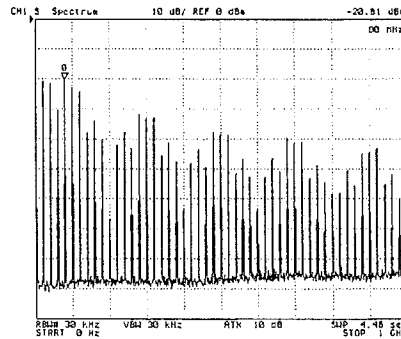


Fig. 10: 200 MBaud 1010 PCM signal spectrum with 8B/10B encoding 0...1GHz.

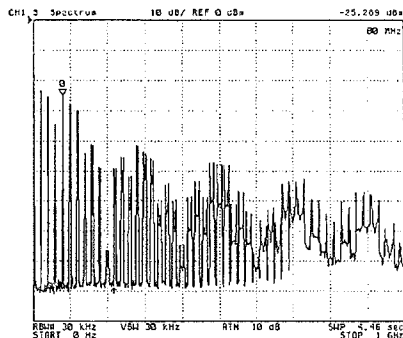


Fig. 11: 200 MBaud 1010 PCM signal spectrum with 8B/10B encoding and FM 0...1GHz.

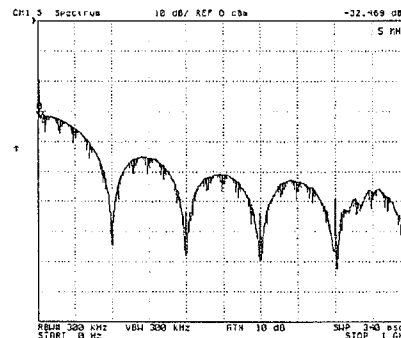


Fig. 12: 200 MBaud 1010 PCM signal spectrum with pseudo noise encoding 0...1GHz.

When a frequency modulation is applied to the 8B/10B signal it results in the spectrum of Fig. 11. Now the maximum amplitude is -25.3 dBm with again 5 dB improvement. Here the frequency modulation only fills the gaps between the 8B/10B signal spectral lines but it cannot flatten the spectrum. A long pseudo noise sequence encoding with a pattern length of 128 bits gives a very even spectrum with a maximum amplitude of -32.5 dBm as shown in Fig. 12. The measured values prove the theoretical considerations. Some deviations are caused by limitations and simplifications of the theoretical model.

4 Summary

When using high speed digital data links considerable care must be taken to meet the requirements of international EMI regulations. With data rates of some hundred to several thousand kBaud the fundamental frequency is in the range of common communication, radio and tv-bands. To reduce interference in general it is better to transfer the information with a broadband signal with even distributed low spectral power density instead of having some discrete high power spectral lines.

This document describes how common used digital data links can be modified in such a way that the spectrum is spread up significantly.

There are two complementing methods to achieve this. The first method is appropriate encoding of the digital signal. The other method is a kind of frequency modulation. This frequency modulation can be done anywhere in the link without affecting transmitter or receiver.

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19.10.00

Herrn
Dr. Georg Lohr
Allinger Straße 75

82223 Eichenau

Exhibit B

17.10.00
KDR/ck

Ihre Erfindungsmeldung vom [REDACTED] (Nr. NT 136)
,Störrarme Signalübertragung‘

Sehr geehrter Herr Dr. Lohr,

hierdurch teilen wir Ihnen mit, daß wir Ihre Dienstleistung, die Sie uns unter oben genannter Nummer gemeldet haben, **unbeschränkt** in Anspruch nehmen (§§ 6, 7 Abs. 1 ArbNErG).

Mit dieser Erklärung gehen alle Rechte an dem Erfindungsgegenstand auf uns über.

Wegen der Höhe der Ihnen zustehenden Erfindervergütung werden wir unmittelbar mit Ihnen in Kontakt treten, wenn eine Verwendung Ihrer Erfindung erfolgt oder ein Schutzrecht erteilt worden ist.

Mit freundlichen Grüßen



Kurt Dollhofer
Geschäftsführer

19.10.00

Your report of an invention dated [REDACTED]
"Interference-free Signal Transmission"

Dear Dr Lohr:

You are hereby informed that we make an **unlimited** claim to your service invention that you have reported to us under the above-indicated number (Paragraphs 6, 7, Section 1 of the Law on Employee Inventions).

With this declaration, all rights to the subject matter of the invention are assigned to us.

Concerning the amount of inventor's compensation due to you, we will contact you immediately when use is made of your invention, or a protective right has been granted.

Yours sincerely,

(signed) Kurt Dollhofer

Managing Director

EXHIBIT B

The New IEEE Standard Dictionary of Electrical and Electronics Terms [Including Abstracts of All Current IEEE Standards]

Fifth Edition

Gediminas P. Kurpis, Chair

Christopher J. Booth, Editor

The Institute of Electrical and Electronics Engineers, Inc.
345 East 47th Street, New York, NY 10017-2394, USA

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January 15, 1993

SH15594

which the relative position of each timeslot can be identified. 1007-1991

(7). See: **display frame**. 610.6-1991

frame alignment. The state in which the frame of the receiving equipment is synchronized with respect to that of the received signal.

1007-1991

frame alignment signal (FAS). The distinctive signal(s) inserted in every frame or once in n frames, always occupying the same relative position(s) within the frame, and used to establish and maintain frame alignment.

1007-1991

frame buffer. See: **bit map**. 610.6-1991

framed plate (storage cell). A plate consisting of a frame supporting active material. See: **battery (primary or secondary)**. [119]

frame, DS1. The DS1 frame consists of 193 bit positions, the first of which is the frame overhead bit position. The remaining 192 bits are available as payload, and can be divided into 24 blocks (channels) of 8 bits each.

1007-1991

frame frequency (television). The number of times per second that the frame is scanned. See: **television**. [119]

frame, intermediate distributing. See: **intermediate distributing frame**.

frame, main distributing. See: **main distributing frame**.

frame rate (data transmission). The repetition rate of the frame. 599-1985w

frame ring (rotating machinery). A plate or assembly of flat plates forming an annulus in a radial plane and serving as a part of the frame to stiffen it. [9]

frame size (as applied to a low-voltage circuit breaker) (power switchgear). A term that denotes the maximum continuous current rating in amperes for all parts except the coils of the direct-acting trip device. C37.100-1981

frame split (rotating machinery). A joint at which a frame may be separated into parts. [9]

frame synchronization (data transmission). The process whereby a given channel at the receiving end is aligned with the corresponding channel at the transmitting end. 599-1985w

framework (rotating machinery). A stationary supporting structure. [9]

frame yoke (field frame) (rotating machinery). The annular support for the poles of a direct-current machine. Note: It may be laminated or of solid metal and forms part of the magnetic circuit. [9]

framing (facsimile). The adjustment of the picture to a desired position in the direction of line progression. See: **recording (facsimile)**.

168-1956w

framing bit errors. Frame bits that are in error. 1007-1991

framing signal (facsimile). A signal used for adjustment of the picture to a desired position in the direction of line progression. See: **facsimile signal (picture signal)**. 168-1956w

Francis turbine. Reaction-type turbine in which the water enters radially and leaves axially.

1020-1988

Fraunhofer diffraction pattern. See: **far-field diffraction pattern**. 812-1984

Fraunhofer pattern (antennas). A radiation pattern obtained in the Fraunhofer region of an antenna. Note: For an antenna focused at infinity a Fraunhofer pattern is a far-field pattern. 145-1983

Fraunhofer region (1) (data transmission). That region of the field in which the energy flow from an antenna proceeds essentially as though coming from a point source located in the vicinity of the antenna. Note: If the antenna has a well-defined aperture D in a given aspect, the Fraunhofer region in that aspect is commonly taken to exist at distances greater than $2D^2/\lambda$ from the aperture, being the wavelength. 599-1985w

(2) (antenna). The region in which the field of antenna is focused. Note: In the Fraunhofer region of an antenna focused at infinity, the values of the fields, when calculated from knowledge of the source distribution of an antenna, are sufficiently accurate when the quadratic phase terms (and higher order terms) are neglected. See: **antenna; far-field region**. 145-1983

free-body meter. A meter that measures the electric field strength at a point above the ground and that is supported in space without conductive contact to earth. Note: Free-body meters are commonly constructed to measure the induced current between two isolated parts of a conductive body. Since the induced current is proportional to the time derivative of the electric field strength, the meter's detector circuit often contains an integrating stage in order to recover the waveform of the electric field. The integrated current waveform also coincides with that of the induced charge. The integrating stage is also desirable, particularly for measurements of electric field with harmonic content, because this stage (i.e., its integrating property) eliminates the excessive weighting of the harmonic components in the induced current signal. 539-1990

free bystander. A free bystander can be a participating slave that is no longer an entrant, or a potential master that has no current need to acquire the bus and is not fairness inhibited. 896.1-1987

free capacitance (1) (conductor). The limiting value of its self-capacitance when all other

IEEE Std 100-1992

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January 15, 1993

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P

- p.** Abbreviation for **pico**. 610.1
- PA (local and metropolitan area networks).** Pre-arbitrated. 802.6-1990
- PABX.** See: **private automatic branch exchange**.
- pace voltage (surge arresters).** A voltage generated by ground current between two points on the surface of the ground at a distance apart corresponding to the conventional length of an ordinary pace. [8], [84]
- pacing (Class 1E connection assemblies).** A method of ongoing qualification by parallel age conditioning. 572-1985
- pack (1).** To compress several items of data in a storage medium in such a way that the individual items can later be recovered. [20], [85]
- (2) (data management) (software).** To store data in a compact form in a storage medium, using known characteristics of the data and medium in such a way as to permit recovery of the data. See also: **packed data**. Contrast with: **unpack**. 610.5-1990, 610.12-1990
- package (software).** A separately compilable software component consisting of related data types, data objects, and subprograms. See also: **data abstraction; encapsulation; information hiding**. 610.12-1990
- package, core (rotating machinery).** The portion of core lying between two adjacent vent ducts or between an end plate and the nearest vent duct. [9]
- packaged magnetron.** An integral structure comprising a magnetron, its magnetic circuit, and its output matching device. See: **magnetron**. 161-1971w, [45]
- packaging (software).** In software development, the assignment of modules to segments to be handled as distinct physical units for execution by a computer. 610.12-1990
- packaging machine.** Any automatic, semiautomatic, or hand-operated apparatus that performs one or more packaging functions, such as, but not limited to, the fabrication, preparation, filling, closing, labeling, or preparing, or both, for final distribution of any type of package or container used to protect or display, or both, any product. 333-1980w
- packet (1) (data communication).** A group of binary digits including data and control elements which is switched and transmitted as a composite whole. The data and control elements and possibly error control information are arranged in a specified format. 168-1956w
- (2) (local and metropolitan area networks).** Consists of a data frame as defined previously, preceded by the preamble and the start frame delimiter. 8802-3:1990, 802.3b,c,d,e-1989
- (3) (MULTIBUS II®).** A block of information that is transmitted within a single transfer operation in message space. See: **transfer operation; message space**. 1296-1987
- ®MULTIBUS II is a registered trademark of Intel Corporation.
- packed array.** An array in which all data elements in the set have non-trivial values. Syn: **dense list**. 610.5-1990
- packed binary data.** Binary data stored in a compact form in a storage medium, using known characteristics of the data and the medium to permit recovery of the data. 610.5-1990
- packed data.** Data stored in a compact form in a storage medium, using known characteristics of the data and the medium to permit recovery of the data. See also: **packed binary data; packed decimal data**. 610.5-1990
- packed decimal data.** Integer data stored in a compact form in a storage medium, using known characteristics of the data and the medium to permit recovery of the data. In the most common implementation, each decimal digit is represented in binary, occupying four bits, and the right-most decimal digit is followed by a four-bit sign digit (hexadecimal A,C,E, or F for positive; B or D for negative). Syn: **signed packed decimal data**. See also: **unsigned packed decimal data**. 610.5-1990
- decimal 275₁₀
 packed decimal 0010 0111 0101 1111₂ = 275F₁₆
 decimal -91₁₀
 packed decimal 0000 1001 0001 1011₂ = 091B₁₆
- packet switching (data communication).** A data transmission process, utilizing addressed packets, whereby a channel is occupied only for the duration of transmission of the packet. See: **circuit switching; message switching; store-and-forward switching**. 168-1956w
- packing density (computing systems).** The number of useful storage cells per unit of dimension, for example, the number of bits per inch stored on a magnetic tape or drum track. [2], [20], [85]
- packing fraction (fiber optics).** In a fiber bundle, the ratio of the aggregate fiber cross-sectional core area to the total cross-sectional area (usually within the ferrule) including cladding and interstitial areas. See: **ferrule; fiber bundle**. 812-1984
- packing gland.** An explosionproof entrance for conductors through the wall of an explosion-proof enclosure, to provide compressed packing completely surrounding the wire or cable, for not less than 1/2 inch measured along the